

Claims:

1. A method of manufacture of an investment casting mold comprising,
  - mixing one or more fibers selected from the group consisting of organic fiber, ceramic fiber and mixtures thereof with one or more ceramic fillers to form
  - 5 a first dry blend,
  - mixing fiber and ceramic filler to form a second dry blend which is the same or different from the first dry blend,
  - mixing the first dry blend with a first colloidal silica sol to form prime coat slurry,
  - 10 mixing the second dry blend with a second colloidal silica sol to form a backup coat slurry wherein the second colloidal silica sol is the same or different from the first colloidal silica sol and wherein the backup coat slurry is the same or different from the prime coat slurry,
  - applying a coating of the prime coat slurry onto an expendable preform to
  - 15 produce a prime coated preform,
  - applying stucco onto the prime coated preform,
  - drying the stuccoed, prime coated preform,
  - applying a coating of the backup coat slurry onto the stuccoed, prime coated preform to produce a backup coated preform,
  - 20 applying stucco onto the backup coated preform to produce a stuccoed, backup coated preform,
  - drying the stuccoed, backup coated preform,
  - removing the expendable preform from the backup coated preform to produce a green shell mold, and
  - 25 heating the green shell mold to a temperature sufficient to produce a fired ceramic shell mold.

2. The method of claim 1 wherein the sol is an ionic silicate or a sol selected from a group consisting of colloidal silica sol, colloidal silica sol modified by latex, ethyl silicate, or mixtures thereof.
- 5 3. The method of claim 1 wherein the sol is colloidal silica sol.
4. The method of claim 1 wherein the fiber in the second dry blend is selected from the group consisting of ceramic fiber, glass fiber, organic fiber, or mixtures thereof.
- 10 5. The method of claim 1 wherein the ceramic filler in any one of the first dry blend and the second dry blend includes ceramic grains which have a particle size of about 20 mesh to about 600 mesh.
- 15 6. The method of claim 1 wherein the ceramic filler in any one of the first dry blend and the second dry blend includes ceramic grains which have a particle size of about -120 mesh to about -325 mesh.
7. The method of claim 1 wherein the ceramic filler in any one of the first dry  
20 blend and the second dry blend includes calcined coke.
8. A method of manufacture of an investment casting mold comprising,  
mixing one or more ceramic fillers with a first colloidal silica sol to  
produce a first prime coat slurry,  
25 mixing ceramic filler with organic fiber to form a dry blend wherein the  
ceramic filler is the same or different from any one of the ceramic fillers in the  
first prime coat slurry,  
mixing the dry blend with a second colloidal silica sol to form a second

prime coat slurry wherein the second colloidal silica sol is the same or different from the first colloidal sol,

mixing the dry blend with a third colloidal silica sol to produce a backup coat slurry wherein the third colloidal silica sol is the same or different from each  
5 of the first colloidal sol and the second colloidal sol,

applying the first prime coat slurry onto an expendable preform to produce a first prime coated preform,

applying a stucco onto the first prime coated preform to produce a stuccoed, first prime coated preform,

10 drying the stuccoed, first prime coated preform to produce a dried, stuccoed first prime coated preform,

applying the second prime coat slurry onto the dried, stuccoed first prime coated preform to produce a preform having a plurality of prime coats,

applying stucco to the preform having a plurality of prime coats to  
15 produce a stuccoed preform having a plurality of prime coats,

drying the stuccoed preform to produce a dried, stuccoed preform having a plurality of prime coats,

applying the backup coat slurry to the dried, stuccoed preform having a plurality of prime coats to produce a backup coated preform,

20 applying stucco onto the backup coated preform to produce a stuccoed, backup coated preform,

drying the stuccoed, backup coated preform,

removing the expendable preform from the backup coated preform to produce a green shell mold, and

25 heating the green shell mold to a temperature sufficient to produce a fired ceramic shell mold.

9. The method of claim 8 wherein at least one of the colloidal silica sols is modified by latex polymer.

10. A method of manufacture of an investment casting mold comprising,

5           mixing one or more ceramic fillers with a first colloidal silica sol to produce a first prime coat slurry,

          mixing a ceramic filler with ceramic fiber to produce a dry blend wherein the ceramic filler is the same or different from any of the ceramic fillers in the first prime coat slurry,

10           mixing the dry blend with a second colloidal silica sol to form a backup coat slurry wherein the second colloidal silica sol is the same or different from the first colloidal sol,

          applying the prime coat slurry onto an expendable preform to produce a prime coated preform,

15           applying stucco onto the prime coated preform to produce a stuccoed, prime coated preform,

          drying the stuccoed, prime coated preform to produce a dried, stuccoed prime coated preform,

20           applying the backup coat slurry to the dried, stuccoed prime coated preform to produce a backup coated preform,

          applying stucco onto the backup coated preform to produce a stuccoed, backup coated preform,

          drying the stuccoed, backup coated preform,

25           removing the expendable preform from the backup coated preform to produce a green shell mold, and

          heating the green shell mold to a temperature sufficient to produce a fired ceramic shell mold.

11. The method of claim 10 wherein at least one of the colloidal silica sols is modified by latex polymer.

12. A method of manufacture of an investment casting mold comprising,

5        mixing one or more ceramic fillers with a first colloidal silica sol to produce a first prime coat slurry,

          mixing fused silica and polypropylene fiber to form a dry blend,

          mixing the dry blend with a second colloidal silica sol to form a second prime coat slurry wherein the second colloidal silica sol is the same or different

10        from the first colloidal silica sol,

          mixing the dry blend with a third colloidal silica sol to produce a backup coat slurry wherein the third colloidal silica sol is the same or different from each of the first colloidal sol and the second colloidal sol,

          applying the first prime coat slurry onto an expendable preform to produce a first prime coated preform,

15        applying stucco onto the first prime coated preform to produce a stuccoed, first prime coated preform,

          drying the stuccoed, first prime coated preform to produce a dried, stuccoed first prime coated preform,

20        applying the second prime coat slurry onto the dried, stuccoed first prime coated preform to produce a preform having a plurality of prime coats,

          applying stucco to the preform to produce a stuccoed preform having a plurality of prime coats,

25        drying the stuccoed preform to produce a dried, stuccoed preform having a plurality of prime coats,

          applying the backup coat slurry to the dried, stuccoed preform having a plurality of prime coats to produce a backup coated preform,

          applying stucco onto the backup coated preform to produce a stuccoed,

backup coated preform,

drying the stuccoed, backup coated preform,

removing the expendable preform from the backup coated preform to  
produce a green shell mold, and

5 heating the green shell mold to a temperature sufficient to produce a fired  
ceramic shell mold.

13. The method of claim 12 wherein at least one of the colloidal silica sols is  
modified by latex polymer.

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14. A method of manufacture of an investment casting mold comprising,

mixing one or more ceramic fillers with a first colloidal silica sol to  
produce a first prime coat slurry,

15 mixing organic fiber with a ceramic filler to form a dry blend wherein the  
ceramic filler is the same or different from any of the ceramic fillers in the first  
prime coat slurry,

mixing the dry blend with a second colloidal silica sol to form a second  
prime coat slurry wherein the second colloidal silica sol is the same or different  
from the first colloidal sol,

20 mixing the dry blend with a third colloidal silica sol to produce a backup  
coat slurry wherein the third colloidal silica sol is the same or different from each  
of the first colloidal sol and the second colloidal sol,

applying the first prime coat slurry onto an expendable preform to  
produce a first prime coated preform,

25 applying stucco onto the first prime coated preform to produce a  
stuccoed, first prime coated preform,

drying the stuccoed, first prime coated preform to produce a dried,  
stuccoed first prime coated preform,

applying the second prime coat slurry onto the dried, stuccoed first prime coated preform to produce a preform having a plurality of prime coats,  
applying stucco to the preform having a plurality of prime coats to produce a stuccoed preform having a plurality of prime coats,  
5 drying the stuccoed preform to produce a dried, stuccoed preform having a plurality of prime coats,  
applying the backup coat slurry to the dried, stuccoed preform having a plurality of prime coats to produce a backup coated preform,  
applying stucco onto the backup coated preform to produce a stuccoed,  
10 backup coated preform,  
drying the stuccoed, backup coated preform,  
removing the expendable preform from the backup coated preform to produce a green shell mold, and  
heating the green shell mold to a temperature sufficient to produce a fired  
15 ceramic shell mold.

15. The method of claim 14 wherein at least one of the colloidal silica sols is modified by latex polymer.

20 16. A method of manufacture of an investment casting mold comprising,  
mixing one or more ceramic fillers with a first aqueous colloidal silica sol to produce a first prime coat slurry,  
mixing nylon fiber with a ceramic filler which is the same or different from any of the ceramic fillers in the first prime coat slurry to form a dry blend,  
25 mixing the dry blend with a second aqueous colloidal silica sol to form a second prime coat slurry wherein the second aqueous colloidal silica sol is the same or different from the first colloidal sol,  
mixing the dry blend with a third aqueous colloidal silica sol to produce a

backup coat slurry wherein the third aqueous colloidal silica sol is the same or different from each of the first colloidal sol and the second colloidal sol,

applying the first prime coat slurry onto an expendable preform to produce a first prime coated preform,

5 applying stucco onto the first prime coated preform to produce a stuccoed, first prime coated preform,

drying the stuccoed, first prime coated preform to produce a dried, stuccoed first prime coated preform,

10 applying the second prime coat slurry onto the dried, stuccoed first prime coated preform to produce a preform having a plurality of prime coats,

applying stucco to the preform having a plurality of prime coats to produce a stuccoed preform having a plurality of prime coats,

drying the stuccoed preform to produce a dried, stuccoed preform having a plurality of prime coats,

15 applying the backup coat slurry to the dried, stuccoed preform having a plurality of prime coats to produce a backup coated preform,

applying stucco onto the backup coated preform to produce a stuccoed, backup coated preform,

drying the stuccoed, backup coated preform,

20 removing the expendable preform from the backup coated preform to produce a green shell mold, and

heating the green shell mold to a temperature sufficient to produce a fired ceramic shell mold.

25 17. The method of claim 16 wherein the colloidal silica sol in the backup slurry is modified by latex polymer.



18. A method of manufacture of an investment casting mold comprising,  
mixing ceramic filler and ceramic fiber to form a dry blend,  
mixing the dry blend with an aqueous colloidal silica sol to form a prime  
coat slurry,

5       applying the prime coat slurry onto an expendable preform to produce a  
prime coated preform,

applying stucco onto the prime coated preform to produce a stuccoed,  
prime coated preform,

drying the stuccoed, prime coated preform to produce a dried, stuccoed  
10 prime coated preform,

applying the slurry onto the dried, stuccoed prime coated preform to  
produce a backup coated preform,

applying stucco onto the backup coated preform to produce a stuccoed,  
backup coated preform,

15       drying the stuccoed, backup coated preform,

removing the expendable preform from the backup coated preform to  
produce a green shell mold, and

heating the green shell mold to a temperature sufficient to produce a fired  
ceramic shell mold.

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19. The method of claim 18 wherein the colloidal silica sol is modified by latex  
polymer.

20. The method of claim 18 wherein the blend includes a plurality of ceramic  
25 fibers.

21. A method of manufacture of an investment casting mold comprising,  
mixing ceramic fillers and organic fiber to form a dry blend,

mixing the blend with an aqueous colloidal silica sol to form a prime coat slurry,

applying the slurry onto an expendable preform to produce a prime coated preform,

5 applying stucco onto the prime coated preform to produce a stuccoed, prime coated preform,

drying the stuccoed, prime coated preform to produce a dried, stuccoed prime coated preform,

10 applying the slurry onto the dried stuccoed, prime coated preform to produce a backup coated preform,

applying stucco onto the backup coated preform to produce a stuccoed, backup coated preform,

drying the stuccoed, backup coated preform,

15 removing the expendable preform from the backup coated preform to produce a green shell mold, and

heating the green shell mold to a temperature sufficient to produce a fired ceramic shell mold.

22. The method of claim 21 wherein the colloidal silica sol is modified by latex  
20 polymer.

23. A method of manufacture of an investment casting mold comprising,

mixing ceramic filler, ceramic fiber and organic fiber to form a dry blend,

25 mixing the blend with an aqueous colloidal silica sol to produce a prime coat slurry,

applying the slurry onto an expendable preform to produce a prime coated preform,

applying stucco onto the prime coated preform to produce a stuccoed,

prime coated preform,

drying the stuccoed, prime coated preform to produce a dried, stuccoed  
prime coated preform,

5 applying the slurry onto the dried, stuccoed, prime coated preform to  
produce a backup coated preform,

applying stucco onto the backup coated preform to produce a stuccoed,  
backup coated preform,

drying the stuccoed, backup coated preform,

10 removing the expendable preform from the backup coated preform to  
produce a green shell mold, and

heating the green shell mold to a temperature sufficient to produce a fired  
ceramic shell mold.

24. The method of claim 23 wherein the colloidal silica sol is modified by latex  
15 polymer.

25. A method of manufacture of an investment casting mold comprising,

forming a dry blend from a mixture of ceramic fillers and ceramic fiber,

20 mixing the blend with an aqueous colloidal silica sol to form a prime coat  
slurry,

applying the slurry onto an expendable preform to produce a prime  
coated preform,

applying stucco onto the prime coated preform to produce a stuccoed,  
prime coated preform,

25 drying the stuccoed, prime coated preform to produce a dried, stuccoed  
prime coated preform,

applying the slurry onto the dried, stuccoed, prime coated preform to  
produce a backup coated preform,

applying stucco onto the backup coated preform to produce a stuccoed,  
backup coated preform,

drying the stuccoed, backup coated preform,

removing the expendable preform from the backup coated preform to  
5 produce a green shell mold, and

heating the green shell mold to a temperature sufficient to produce a fired  
ceramic shell mold.

26. The method of claim 25 wherein the colloidal silica sol is modified by latex  
10 polymer.

27. A method of manufacture of an investment casting mold comprising,

forming a blend from a first mixture of ceramic fillers, and a second  
mixture of ceramic fibers,

15 mixing the blend with an aqueous colloidal silica sol to form a prime coat  
slurry,

applying the prime coat slurry onto an expendable preform to produce a  
prime coated preform,

20 applying stucco onto the prime coated preform to produce a stuccoed,  
prime coated preform,

drying the stuccoed, prime coated preform to produce a dried, stuccoed  
prime coated preform,

applying the slurry onto the dried, stuccoed, prime coated preform to  
produce a backup coated preform,

25 applying stucco onto the backup coated preform to produce a stuccoed,  
backup coated preform,

drying the stuccoed, backup coated preform,

removing the expendable preform from the backup coated preform to

produce a green shell mold, and

heating the green shell mold to a temperature sufficient to produce a fired ceramic shell mold.

- 5 28. The method of claim 27 wherein the colloidal silica sol is modified by latex polymer.

29. A method of manufacture of an investment casting mold comprising,

forming a blend from a first mixture of ceramic fillers and a second

- 10 mixture of ceramic filler and organic fiber,

mixing the blend with an aqueous colloidal silica sol to form a prime coat slurry,

applying the slurry onto an expendable preform to produce a prime coated preform,

- 15 applying stucco onto the prime coated preform to produce a stuccoed, prime coated preform,

drying the stuccoed, prime coated preform to produce a dried, stuccoed prime coated preform,

applying the slurry onto the dried, stuccoed, prime coated preform to  
20 produce a backup coated preform,

applying stucco onto the backup coated preform to produce a stuccoed, backup coated preform,

drying the stuccoed, backup coated preform,

removing the expendable preform from the backup coated preform to

- 25 produce a green shell mold, and

heating the green shell mold to a temperature sufficient to produce a fired ceramic shell mold.

30. The method of claim 29 wherein the colloidal silica sol is modified by latex polymer.

31. A method of manufacture of an investment casting mold comprising,

5        forming a blend from a first mixture of ceramic fillers, and a second mixture of ceramic fiber and organic fiber,

         mixing the blend with an aqueous silica sol to produce a prime coat slurry,

         applying the slurry onto an expendable preform to produce a prime  
10       coated preform,

         applying stucco onto the prime coated preform to produce a stuccoed, prime coated preform,

         drying the stuccoed, prime coated preform to produce a dried, stuccoed prime coated preform,

15       applying the slurry onto the dried, stuccoed, prime coated preform to produce a backup coated preform,

         applying stucco onto the backup coated preform to produce a stuccoed, backup coated preform,

         drying the stuccoed, backup coated preform,

20       removing the expendable preform from the backup coated preform to produce a green shell mold, and

         heating the green shell mold to a temperature sufficient to produce a fired ceramic shell mold.

25       32. The method of claim 31 wherein the colloidal silica sol is modified by latex polymer.

33. A method of manufacture of an investment casting mold comprising,  
mixing one or more ceramic fillers with an aqueous colloidal silica sol to  
produce a prime coat slurry,  
mixing a dry blend of ceramic filler and fiber with an aqueous colloidal  
5 silica sol to form a backup coat slurry,  
applying the prime coat slurry onto an expendable preform to produce a  
prime coated preform,  
applying stucco onto the prime coated preform to produce a stuccoed,  
prime coated preform,  
10 drying the stuccoed, prime coated preform to produce a dried, stuccoed  
prime coated preform,  
applying the backup coat slurry to the stuccoed, prime coated preform to  
produce a backup coated preform,  
applying stucco onto the backup coated preform to produce a stuccoed,  
15 backup coated preform,  
drying the stuccoed, backup coated preform,  
removing the expendable preform from the backup coated preform to  
produce a green shell mold, and  
heating the green shell mold to a temperature sufficient to produce a fired  
20 ceramic shell mold.

34. The method of claim 33 wherein at least one of the colloidal silica sols is  
modified by latex polymer.

25 35. A method of manufacture of an investment casting mold comprising,  
mixing one or more ceramic fillers with an aqueous colloidal silica sol to  
produce a prime coat slurry that is substantially free of fiber,  
mixing a dry blend of ceramic filler and fiber with an aqueous colloidal

silica sol to form a backup coat slurry,

applying the prime coat slurry onto an expendable preform to produce a prime coated preform,

5 applying stucco onto the prime coated preform to produce a stuccoed,  
first prime coated preform,

drying the stuccoed, prime coated preform to produce a dried, stuccoed prime coated preform,

applying the backup coat slurry to the stuccoed, prime coated preform to produce a backup coated preform,

10 applying stucco onto the backup coated preform to produce a stuccoed,  
backup coated preform,

drying the stuccoed, backup coated preform,

removing the expendable preform from the backup coated preform to produce a green shell mold, and

15 heating the green shell mold to a temperature sufficient to produce a fired ceramic shell mold.

36. The method of claim 35 wherein at least one of the colloidal silica sols is modified by latex polymer.